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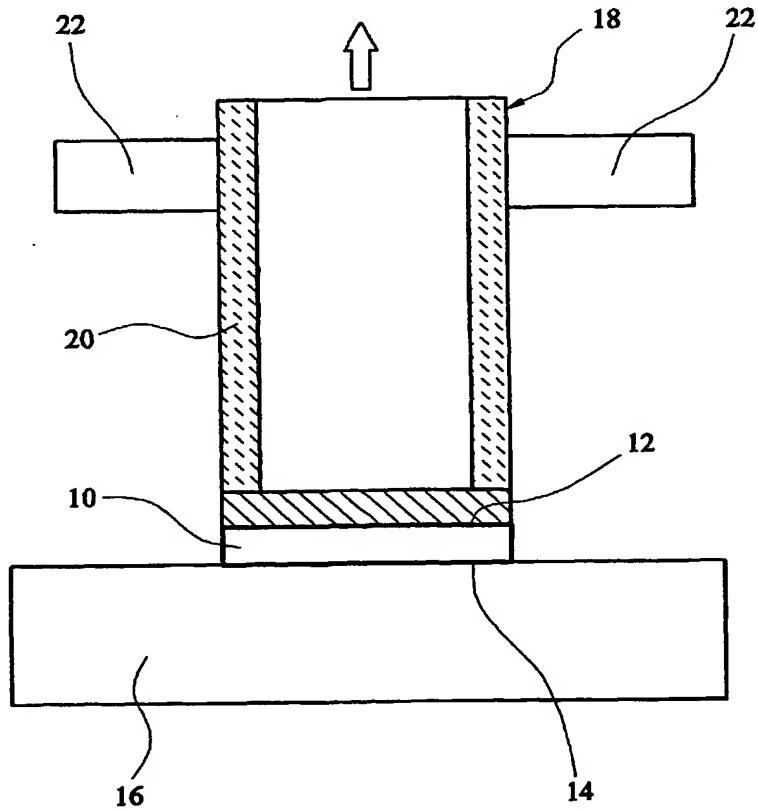
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(54) Title: OPTEOLECTRONIC DEVICES



(57) Abstract: A light emitting semiconductor device (10) mounted on a heat sink (16) and having a heat pipe (18) located on its upper surface (12). The heat pipe (18) comprises a sealed cylindrical member of transparent or translucent material having a wick (20) disposed down the side and along the bottom thereof. The heat (18) is partially filled with a liquid which is placed under a partial vacuum to reduce its boiling point. A bundle of optical fibres may be provided within the heat pipe (18), with the gaps created between the optical fibres providing an efficient capillary action within the heat pipe (18) for transport of vapour to the cool end of the pipe (18) and for transport of condensed coolant to the hot end of the pipe (18).

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INTERNATIONAL SEARCH REPORT

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A. CLASSIFICATION OF SUBJECT MATTER
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According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
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Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data, PAJ, INSPEC

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	PATENT ABSTRACTS OF JAPAN vol. 2000, no. 19, 5 June 2001 (2001-06-05) -& JP 2001 036153 A (MATSUSHITA ELECTRIC), 9 February 2001 (2001-02-09) paragraphs '0017!-'0020! — EP 0 658 933 A (SHARP KK) 21 June 1995 (1995-06-21) column 19, line 49 -column 21, line 47 — US 3 860 847 A (CARLEY J) 14 January 1975 (1975-01-14) column 2, line 35 -column 4, line 18 — —/—	1-14
X		1-14
X		1-6,8-14

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Patent family members are listed in annex.

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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT		
Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	PATENT ABSTRACTS OF JAPAN vol. 004, no. 079 (E-014), 7 June 1980 (1980-06-07) & JP 55 046589 A (FUJITSU LTD), 1 April 1980 (1980-04-01) abstract ---	1-6,8-14
X	FR 1 428 845 A (THOMSON HOUSTON CO) 18 February 1966 (1966-02-18) page 2, left-hand column ---	1-6,8-14
X	GB 1 216 090 A (PHILIPS ELECTRONIC) 16 December 1970 (1970-12-16) page 3, line 50-119 ---	1-3,5, 11-14
X	US 3 825 741 A (OLAND B ET AL) 23 July 1974 (1974-07-23) column 4, line 65 -column 5, line 27 ---	1-3,5, 11-14
X	EP 0 789 405 A (TOYOTA MOTOR CO) 13 August 1997 (1997-08-13) page 3, line 47-56 ---	1-3,5, 11-14
A	GB 1 295 775 A (RCA CORP) 8 November 1972 (1972-11-08) page 2, line 77 -page 4, line 89 ---	1-7, 11-14
A	PATENT ABSTRACTS OF JAPAN vol. 009, no. 321 (E-367), 17 December 1985 (1985-12-17) & JP 60 153188 A (TOSHIAKI SHINMURA), 12 August 1985 (1985-08-12) abstract ---	1,11-14
A	WO 99/16136 A (UNIV BRISTOL) 1 April 1999 (1999-04-01) page 13, paragraph 4 -page 14, paragraph 3 ---	1,11-14
A	EP 0 435 473 A (DIGITAL EQUIPMENT CORP) 3 July 1991 (1991-07-03) the whole document ---	1,11-14
A	DATABASE WPI Section Ch, Week 198420 Derwent Publications Ltd., London, GB; Class J08, AN 1984-125544 XP002279226 -& SU 1 035 400 A (KURIKHIN V), 15 August 1983 (1983-08-15) abstract ---	8-10
P,X	US 2003/052584 A1 (NAGAI H ET AL) 20 March 2003 (2003-03-20) paragraphs '0087!-'0092! ---	1-3,5, 11-14

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/GB 03/02431

Patent document cited in search report		Publication date	Patent family member(s)		Publication date
JP 2001036153	A	09-02-2001	NONE		
EP 0658933	A	21-06-1995	JP 7170024 A		04-07-1995
			JP 3074112 B2		07-08-2000
			JP 7335982 A		22-12-1995
			DE 69428578 D1		15-11-2001
			DE 69428578 T2		27-06-2002
			EP 0658933 A2		21-06-1995
US 3860847	A	14-01-1975	NONE		
JP 55046589 3	A		NONE		
FR 1428845	A	18-02-1966	NONE		
GB 1216090	A	16-12-1970	FR 1519635 A		05-04-1968
			DE 1589274 A1		05-03-1970
			US 3508100 A		21-04-1970
US 3825741	A	23-07-1974	GB 1447677 A		25-08-1976
			JP 50132935 A		21-10-1975
			NL 7400580 A		09-09-1974
EP 0789405	A	13-08-1997	JP 9213980 A		15-08-1997
			EP 0789405 A2		13-08-1997
GB 1295775	A	08-11-1972	CA 926033 A1		08-05-1973
			DE 2015518 A1		15-10-1970
			FR 2042243 A5		05-02-1971
			JP 48022017 B		03-07-1973
JP 60153188 3	A		NONE		
WO 9916136	A	01-04-1999	GB 2329756 A		31-03-1999
			AU 9178398 A		12-04-1999
			BR 9813223 A		29-08-2000
			CA 2304166 A1		01-04-1999
			CN 1276917 T		13-12-2000
			EP 1019970 A1		19-07-2000
			WO 9916136 A1		01-04-1999
			JP 2001517875 T		09-10-2001
EP 0435473	A	03-07-1991	US 4995451 A		26-02-1991
			DE 69031651 D1		04-12-1997
			DE 69031651 T2		09-04-1998
			EP 0435473 A2		03-07-1991
			JP 2080206 C		09-08-1996
			JP 6021284 A		28-01-1994
			JP 7112031 B		29-11-1995
			KR 193331 B1		01-07-1999
SU 1035400	A	15-08-1983	SU 1035400 A1		15-08-1983
US 2003052584	A1	20-03-2003	JP 2003092009 A		28-03-2003